Supplementary for systematic and random errors

Systematic error

Suppose that validity of the variable on y-axis is of interest. Its systematic error in reference to the other on x-axis can be described using the intercept and slope of the regression line:

- The intercept 'c' provides a measure of the fixed systematic error between the two variables, i.e. one method provides values that are different to those from the other by a fixed amount. A value of 0 for c indicates no fixed error. Confidence intervals (e.g. 95%) can be used to examine whether $c \neq 0$ and thus determine whether fixed error is statistically significant.
- The slope, m, provides a measure of the proportional error between the two variables, i.e. one method provides data that are different to those from the other by an amount that is proportional to the level of the measurement. A value of 1 for m indicates no proportional error. Confidence intervals (e.g. 95%) can be used to examine whether $m \neq 1$ and thus determine whether proportional error is present.

Random error

Random error inherently exists in any measurements. The influence of random errors on the regression estimates vary whether the error is present in the variable on y-axis or the other on x-axis. If the random error were present in the variable on y-axis, estimates of the slope and intercept would become more imprecise, but estimates themselves would be unbiased. By contrast, if the error is present in the variable on x-axis, the slope would be attenuated or 'diluted' toward the null. Thus, effects of random errors would vary by how a regression line would be fitted.

References

[1] https://dapa-toolkit.mrc.ac.uk/concepts/statistical-assessment